

PATHOLOGY OF CHOLERA

BRITTAN

1849

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REPORT OF A SERIES
OF
MICROSCOPICAL INVESTIGATIONS
OF THE
PATHOLOGY OF CHOLERA.

BY

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THE phenomena of such a disease as cholera, a great pestilence which, sweeping over the world, involves all lands and all nations in one common dread and mourning, awaken an universal interest far more deep and anxious than any ordinary curiosity in the current of passing events. The medical profession has been appealed to, but with the effect, unfortunately, rather of increasing the mystery and apprehension, than of imparting confidence. It must be honestly confessed that we know nothing of the exact nature and cause of cholera, and in the absence of any one common point on which all professional men are agreed, it would seem as if each considered himself at liberty to throw out his opinions and theories, though based on no previously recognised principle, and without a single well-ascertained fact to support them,—perhaps in the vain hope that at last, in their very multiplicity and variety, some one must hit upon the true explanation. Thus it is that our daily papers and medical periodicals teem with histories, theories, remedies, and even specifics, of so directly opposite character, all eagerly devoured by the public, and all alike falling before the test of inquiry and experience, until the disease has begun to be looked upon as a hopelessly inscrutable mystery, and anything that is put forward in regard to it as only another baseless speculation.

Influenced by these circumstances, I have been most anxious to avoid doing or saying anything that could add to the confusion, or mislead those who were really studying the disease, from the right path, and have refrained from making public my own opinions, until the facts they were based on had been submitted to the examination of those most competent to give an opinion on their validity. I have now done so. I have shown to some of the best microscopical authorities in the kingdom my own specimens prepared from cases described in Table I., and

represented by the engravings. I have substantiated them on examples furnished by these gentlemen themselves, and it is with their full concurrence and assurance of their importance that I lay the following facts before the profession. It must be borne in mind that they are put forward as facts, and not mere opinions, and that the validity of my statements have been and can be demonstrated to be true or false by anyone who will take the trouble. In order, however, to simplify the whole matter as much as possible, I shall confine myself to a plain historical detail of the investigations.

On Monday, July 9th, in conjunction with Mr. J. G. Swayne, as fellow-member of a sub-committee appointed by the Bristol Medico-Chirurgical Society for the microscopic investigation of choleraic evacuations, I examined two specimens of rice-water dejection (numbers 1 and 2 in both tables); and on comparing our drawings made from them, and produced before the sub-committee, we were struck with the peculiar appearance of certain bodies depicted in each. On further prosecuting this investigation, I found these bodies to be constantly present in the rice-water evacuation of cholera patients, and offering the same characteristic appearance that distinguished them from anything I had before observed. In order to ascertain if they bore in their size or quantity any relation to the severity of the symptoms, I endeavoured to obtain specimens passed by the same patient at different periods, as well as to complete the observation by an account of his condition at the time. The result was, that as several cases in my table indicated, and as other cases not recorded seemed to prove, I became convinced that a certain relation does exist between the size and number of these bodies, and the time elapsed after the seizure, taken in connection with the severity of the symptoms. That is to say, they are small and clearly defined in the matter vomited (fig. 2);

they become larger and more compound in the dejections (fig. 3); and as the disease progresses favourably, where I have had the opportunity of examining, they vanish as the symptoms disappear, and the motions regain their natural appearance. I have also found that in very rapidly fatal cases these bodies are sometimes to be met with only in very small quantity, or are altogether absent, though this observation must be qualified by the remark that it is not always possible, or at all events has not been with me, to obtain portions of every motion passed, and that these bodies might have been present in those not examined.* It must also be recollected that but a small quantity is saved for investigation, and but an infinitesimal part of that even ever comes actually on the stage of the microscope. My observations contained in Table I.

were made on cases taken just as they came under my notice, and without selection; some in the cholera hospital, some through the kindness of Mr. Ralph Bernard, in the Bridewell: they extend in dates from July the 9th, to July the 30th. Whilst collecting this series, I examined and compared the specimens with others obtained from patients free from cholera. I found that in healthy solid motions these bodies did not exist (fig. 4), nor could I meet with them in the fluid stools of typhus and other diseases, but that they were present in the cases of severe choleraic diarrhœa so prevalent in districts where the disease abounds; and I was thus led to the necessary inference that these bodies were peculiar to the evacuations of cholera patients, and must have some essential relation to the disease.

FIG. 1.



* On every opportunity that I have had of examining the intestines of those who died from cholera, these bodies have been found adhering to the mucous membrane in shreds of white matter,

and very abundant; and the inference is, than it these very rapid cases they are in the intestines, though not given off in the evacuations.

FIG. 2.



FIG. 3.



FIG. 4.



The observations contained in Table II., collected by Mr. Swayne, on cases in the cholera hospital, with the exception of Nos. 1 and 2 (the cases from the comparison of the drawings of which we were first led to notice these peculiar bodies), were made subsequently to mine, and date from August 2nd to the present time. He was prevented from continuing these first investigations with me, and as his observations were taken quite independently of my own, which they so fully confirm, I have thought it better to give them in a separate form. (See page 8.)

Having been thus led to consider these bodies (which, from the characteristic of their appearance, I have termed annular bodies), in some manner essentially connected with cholera, I wished to ascertain whether it might be as cause and agent, or effect and product: that it could not be the latter seemed evident at once from the fact that they were unlike any of the known healthy or morbid elements of the body, or secretions, and as they were found in the vomited matters apparently in

an early stage of development, it seemed probable they were introduced from without, and would be met with in the atmosphere, &c. of places where cholera was rife. Accordingly, with the view to test the truth of this supposition, on July 19th, with the kind assistance of, and an apparatus suggested by, Dr. Bernard, I condensed about 3j. of fluid from the atmosphere of a room in a house from which five patients had been removed the day previous to the cholera hospital,* and found in it bodies of the same appearance as those represented in fig. 1. I soon afterwards repeated the experiment, with the aid of Mr. Ralph Bernard, in a cell in the bridewell, which had been unoccupied for some time, but adjoining cells the occupants of some of which had been seized with cholera, one of whom died the day before. Here, also, the same result was obtained, and from a specimen preserved, which has been carefully examined by many excellent microscop-

* No. 8 and 9 are two of these cases, and two of the others died.

pists, fig. 1 is accurately copied. The same experiment was then tried in situations free from cholera, but with a negative result: the fluid here obtained was destitute of these bodies, and contained only small portions of hyaline structureless matter, also observed in the first. I have since repeated these experiments, aided by Dr. William Budd, several times with the same positive and negative results, and therefore feel justified in stating that the same will follow similar investigations made elsewhere, if the necessary care be taken, and a glass of sufficiently high power (I used a Ross's 1-12th) be employed. The only question remaining is, as to the identity of the annular bodies thus shown to exist in the atmosphere of cholera districts, and in the vomited matters and evacuations of cholera patients. Most of those to whom I have shown the specimens entertain no doubt on the subject, and all seem to concur in their identity of form.

This is all that is possible in respect to matters of such extreme minuteness, and we must, I imagine, be satisfied here, as in similar cases, to form our opinion on circumstantial and corroborating evidence. And when we consider that this form is in itself of too definite a character to be one of mere chance; that the sizes are progressive, accurate measurement showing those in atmosphere fig. 1 to average from the 10,000th to the 3,000th of an inch in diameter; those in vomit fig. 2, from the 8,000th to the 5,000th; those in dejections, fig. 3, from the 6,000th to the 500th; whilst they are met with in the same specimen of dejection in all the intermediate stages of palpably the same object;—the inference is, it appears to me, conclusive, that the annular bodies of atmosphere, vomit and dejection, are but the three stages of development of one and the same body, of whatever nature it may be. A reference to fig. 3 will show them in almost all these stages, some being nearly as small as those in the atmosphere, others intermediate, evincing a commencement of compound character, whilst the largest again frequently seem parent cells containing young cells in their walls and interior, or broken up into a number of young cells more or less separated from each

other. I have seen some much larger than the largest here represented, occasionally entire, but more frequently broken with a sharp irregular fracture, the morsels presenting in some measure the same characteristic annulus as the parent cell did. Their form is too peculiar to need further comment, the light ring round them giving a peculiar cupped appearance, which is unmistakable, especially to one who has seen the drawings.

Having thus given a detailed account of the mode in which I was led to the discovery of these bodies in the atmosphere and evacuations, it might be expected that I should enter more fully into a description of their nature; but, as I have stated in the commencement of this report, my object is simply to lay before the profession the facts as I have found them, that they may receive the attention and examination which I believe they deserve, and be tested and proved by a repetition of my own experiments. To this end I shall be happy to give any information to those desirous of prosecuting the research, fully satisfied that the more they are examined the more fully will they be established, and the more important will be the results that may flow from their knowledge, and with the earnest hope that we may through them obtain, if no more, at least one common ascertained fact on which the profession may be agreed, and by which our inquiries into the cause and effect of this and other allied diseases may be directed in the right path.

On this account, also, I have studiously avoided giving any opinion at all on the facts brought forward, lest I might by so doing distract attention from them, and because I would wish them to stand alone as a fixed and demonstrated truth, from which others, as well as myself, may draw their inferences.

I have necessarily formed opinions, and been led by circumstances which occur only in the actual practical investigation of such subjects, to conclusions which may or may not be approved by others, and I should therefore wish these to be considered as totally distinct from the facts stated in this report, and shall probably make them the subject of a paper in a future number.

TABLE No. I.

Sex.	Age.	Date of Seizure.	Date of Evacuation after Seizure.	Character of Evacuation.	Granules and Granular Cells.	Annular Bodies.	Muscular and Vegetable Tissue.	Animalculæ.	Crystals, Blood, Epithelium.	OBSERVATIONS.
1. F.	18	July 10	12 hours.	Rather thick.	Many.	Many.	Abundant.	None.	None.	Collapse extreme, no urine, died 13th July.
2. F.	6	July 9	12 hours.	As usual.	Single and in masses.	Few.	Abundant.	None.	None.	Recovered, collapse slight.
3. F.	6	July 10	6 hours.	As usual.	Ditto.	Few.	Abundant.	None.	None.	Died 13th.
4. M.	70	July 11	7 hours.	Passed in bed under him, but the flocculi examined contained.	Many.	Not seen.	Abundant.	Sarcina ventriculi.	None.	Evacuations always passed under him.
			24 "	Ditto.	Many.	Many.	Abundant.	Ditto.	None.	Hyaline, jelly-like matter, more stringy; contained large cells like ova.
			36 "	Ditto.	Many.	Many.	Abundant.	Ditto.	None.	Last motion darker, but reaction never fairly came on: died 15th.
5. M.	40	July 12	28 hours	Fluid, almost without flocculi.	Many.	Few, very small.	None.	Vibriones, very many.	Few large phosphates.	Convalescent 14th.
6. M.	30	July 17	8 hours.	Very fluid.	Many.	Many.	None.	None.	Crystals.	Very severe and rapid case; died same day.
7. F.	35	July 14	5 days.	Semi-opaque, without sediment.	Many.	None.	None.	None.	Crystals in abundance.	No reaction; query was it urine? lingered a long time, then died.
8. M.	40	July 15	4 days.	Yellow ever since seized, fluid, with flocculi.	Many.	Many dyed yellow.	None.	None.	Phosphates.	21st, severely salivated; re-covered.
9. F.	4	July 17	2 hours.	Very transparent fluid.	Many.	Many very clear.	Vegetable.	None.	Crystals.	Died 11 A.M. 17th.

10. F.	30	July 17	24 hours.	Passed under her in bed.	Many.	Few.	None.	None.	None.	Collapse moderate from the first, but without any good reaction. Passed a little water. No cramp; no vomiting: had arrowroot and broth; recovered.
			48 72 96	1st in pan. Darker and thicker. Dark green, very viscid.	Ditto. Ditto. Ditto.	Many large. Fewer. Fewer.	None. None. None.	None. None. None. Crystals.	None.	
11. M.	40	July 20	8 hours.	Yellow fluid, with flocculi.	Many.	Few.	None.	Many, and vibriones.	None.	Died same day; evacuations yellow from the first: this man came from London the night before.
12. M.	—	July 19	12 hours.	Alkaline, very transparent, with semi-transparent flocculi.	Many in hyaline matter.	Few.	Abundant.	None.	Epithelial scale.	Acid. Acet. caused most of this matter to disappear, but did not alter the annular bodies; died same day.
13. F.	45	July 20	20 hours.	As usual.	Many.	Few, small.	None.	None.	None.	Collapse not deep; passed urine all the time; recovered, after 2 weeks in Convalescent Ward.
14. M.	35	July 21	2 hours.	Without flocculi.	Few.	Few.	None.	None.	None.	Collapse moderate, now subsiding; passed urine; recovered.
15. M.	—	July 23 " 24	9 hours. 22 "	Very clear, fluid, with small hyaline flocculi. Ditto.	Many. Many.	Few, small. Few, small.	None. None.	None. None.	None. Few Crystals.	Vomiting and decided collapse; passed very few evacuations; that 22 hours after seizure was the last. Died 7 A.M.
16. F.	25	July 23	24 hours.	Very clear, fluid, with flocculi.	Many.	None.	None.	None.	None.	Decided collapse; pulse and voice-less; about 4 oz. urine drawn by catheter.
			30 72	More viscid. Flocks like jelly.	Many. Many.	Many, small. None.	None. Vegetable.	None. None.	Crystals. Stellate, and dark lithic acid.	Warmer; only evacuation since morning. No urine since above; heat fair; pulse fair; passed about 1½ pint of very thick whitish urine.

TABLE No. I.—*continued.*

Sex.	Age.	Date of Seizure.	Date of Evacuation.	Character of Evacuations.	Granules and Granular Cells.	Annular Bodies.	Muscular and Vegetable Tissue.	Animalculæ.	Crystals, Blood, Epithelium.	OBSERVATIONS.
16. F.	25	30	7 days.	Dark green thick fluid.	Many.	None.	None.	None.	Phosphates, chlorate of potash, and irregular.	Only evacuation during last 72 hours; recovered.
17. F.	24	July 26	12 hours.	Clear, with white flocculi.	Many.	Only 2 or 3 observed.	Very little.	None.	None.	Collapse extreme; not much purging, but incessant vomiting; died 28th.
18. F.	26	July 29	4 hours.	Very fluid, scarcely any flocculi.	Many.	Many.	Little.	None.	None.	Died.
		9	"	Same.	Many.	Many large.	None.	None.	Stellate.	
		21	"	Thick and viscid.						
19. F.	30	July 24	2 hours.	Very liquid.	Many.	Many.	Vegetable.	None.	Phosphates.	Diarrhoea yesterday, with rice-water evacuations; no decided collapse; no vomiting; no cramps; heat and pulse fair; voice ordinary, but eyes rather sunk.
			12 "	Ditto.	Many.	Many small.	Vegetable.	None.	Phosphates.	More collapsed.
			26 "	Ditto.	Many.	Very many.	Vegetable.	None.	Phosphates.	Colder and more collapsed; pulse and voice not very much altered; says she passes urine with evacuations.
			48 "	Yellow, viscid like, thick gum, without flocculi.	Many.	Few.	Vegetable.	None.	Phosphates, and others in stellate and irregular masses.	Same.
20. M.	20	July 24	6 days.	Very flocculent.	Many.	None.	Vegetable.	None.	Ditto.	Recovered.

CASE VII. I was unable to obtain any other specimen from this patient, and, as the observation states, there was strong reason for supposing it to be in great part, if not entirely, urine.—CASE XVI. It will be remarked that in the first specimen examined no annular bodies were found; that they were plenty and small in the next, six hours afterwards, and none again in the next, forty-two hours later—the intermediate not having been obtained; that in the next passed after recovery, four days later, there were also none to be met with.

TABLE No. II.—By J. G. SWAYNE, ESQ.

No. and Sex.	Age.	Date of admission.	Date of Evacuation.	Character of evacuation.	Mucus.	Annular bodies.	Muscular and Vegetable Fibre.	Epithelium.	Blood.	Crystals.	OBSERVATIONS.
1. F.	18	July 10	24 hours.	Tolerably clear. Rice water, with thick white flocculent deposit.	Little.	Tolerably abundant; medium size.	Both.	None.	None.	None.	Died, July 13.
2. F.	6	July 9	12 hours.	Ditto.	Much.	Few and small.	Both.	None.	None.	None.	Recovered.
3. M.	25	July 31	Aug. 3	Thin, serous, and reddish.	Little.	Few; of medium size, more or less broken.	Vegetable.	None.	Abundant and altered in shape.	Phosphates. Lithate of ammonia, with lithic acid, and dum-bell crystals of oxalate of lime.	Recovered, although a rather severe case.
4. F.	17	July 27	Aug. 2	Semi-fluid, and tinged deep yellow, with bile; very large whitish flocculi.	None.	Many; mostly very large; containing small cells; their walls thick and distinctly cellular in structure.	Vegetable.	None.	None.	Lithate of ammonia; black rounded granules.	Recovered.
5. M.	26	Aug. 1	Aug. 2	Thin yellowish matter vomited.	Little.	Few and small, with discoloured walls.	Starch and oil-globules.	Much.	None.	None.	Not a very bad case. Recovered.
6. M.	—	Aug. 3	Aug. 3	Dark red, bloody; chiefly grumous blood.	Little.	A few large and small.	None.	None.	Abundant.	Phosphates.	Recovered. This man lost the tip of his nose from gangrene, which came on during collapse.
7. M.	19	Aug. 3	Aug. 5	Thin, with flocculi.	Little.	Few.	Both.	None.	None.	Large Phosphatic crystals.	Recovered.

TABLE No. II.—*continued.*

No. and Sex.	Age.	Date of admission.	Date of Evacuation.	Mucus.	Annular Bodies.	Muscular and Vegetable Fibre.	Epithelium.	Blood.	Crystals.	OBSERVATIONS
8. M.	42	Aug. 4	Aug. 5	Little.	Very many; some large; the greater part small, forming almost the entire precipitate, with some granular amorphous matter.	Both; large cells, with transparent walls containing raphides.	None.	None.	None.	Recovered.
				Plentiful.	Very few; medium.	Starch granules.	None.	None.	None.	
				Little, with hyaline basis	Not very abundant.	Both.	A few scales.	None.	Phosphates.	
				Little.	Very few, and not distinct.	None.	Plenty, chiefly tessellate.	None.	None.	
9. M.	13	Aug. 5	Aug. 5	Little.	Very few, and not very distinct.	Vegetable containing raphides.	None.	None.	None; a plentiful deposit of black amorphous matter.	Died on the 11th.
				Much, with hyaline basis	Abundant; some very large and containing others.	Ditto and starch.	None.	None.	None; black amorphous matter.	
10. M.	14	Aug. 7	Aug. 7	Ditto.	None.	None.	Squamous.	None.	None.	Recovered.
				Very little.	Very few, and not distinct.	None.	Ditto, much.	None.	None.	
11. F.	18	Aug. 9.	Aug. 9	Very abundant.	None.	None.	None.	None.	Agreat number of small polyhedral crystals, common salt (?) some black amorphous grains.	Unusually severe. Died in a few hours.

12. M.	43	Aug. 11	12 hours.	Thin and serous, with slimy mucous deposit.	Ditto.	A few, not very large.	None.	1 or 2 scales.	None.	Ditto.	A very severe case. Collapse extreme. Died on the 12th.
13. M.	46	Aug. 11	12 hours.	Thin and serous.	Plenty.	Several of tolerable large size and deep brown colour, some containing very distinct cells of small size; a great number of the latter floating.	None.	Tolerable plentiful squamous.	None.	Ditto.	Recovered.
14. M.	35	Aug. 11	Aug. 11	Thin and mucous.	Abundant with granules.	Very few, or none. There were a few large granular cells, but these were by no means distinct.	A few vegetable cells.	Not much, squamous.	None.	None.	Recovered.
15. M.	30	Aug. 14	Aug. 14	Thin and clear, depositing transparent shreds.	Very many, with hyaline basis.	Hardly any, and these doubtful.	Vegetable cells and fibre.	None.	None.	Phosphates and long prisms.	Recovered.
16. M.	28	Aug. 14	Aug. 14	Thin and gelatinous.	Plentiful, with granular matter.	But few and much broken; some small cells of a deep brown colour, and aggregated together, in form resembling annular bodies.	None.	None.	None.	Large Crystals of phosphates.	Severe case, and died on the 16th.
17. F.	9	Aug. 14	Aug. 14	Thick and flaky.	Not much; hyaline matter, sprinkled with very fine granules and black amorphous matter.	A few large, more or less broken.	Starch, vegetable cells, and fibre.	A few scales.	None; oil-globules.	None.	Died on the 16th.

TABLE No. II.—*continued.*

No. and Sex.	Sex.	Date of admission.	Date of Evacuation.	Character of evacuation.	Mucus.	Annular Bodies.	Muscular and Vegetable Fibre.	Epithelium.	Blood.	Crystals.	OBSERVATIONS.
18. M.	10	Aug. 15	Aug. 15	Thin matter vomited.	Little.	A few large cells, their walls very distinctly cellular; a vast number of small cells; some oval; mostly aggregated like torulæ.	A great many vibriones, also paramæcia, exhibiting a very active movement.	The squamous form plentiful.	None.	None; black amorphous grains.	Died in secondary fever on August 20.
19. M.	47	Aug. 20	Aug. 20	Tinged with bile, with thick flocculent deposit.	Not much hyaline basis	Very abundant and distinct; some very large. The flocculi chiefly composed of them.	Vegetable cells and fibre.	None.	None.	A few prisms.	A bad case. Died same day.
20. F.	28	Aug. 18	Aug. 23	Thin, greenish, and serous.	None; granular matter	Tolerably abundant; both large and small; also large simple cells without nuclei.	None.	A few scales.	None.	A few, apparently lithic acid.	One of the worst cases. Died in a few hours.
21. F.	35	Sept. 8	Sept. 8	Thin and clear, with yellow flocculent deposit.	Abundant, with hyaline basis.	Very abundant; of all sizes.	Vegetable cells.	None.	None.	None.	A very severe case; never rallied out of the cold stage. Died Sept. 11.
			"	Rather thin, with thick yellow deposit.	Ditto.	Not many, and those small.	None.	None.	None.	None.	
			"	Thick, dark, yellow, semi-fluid, and pul-taceous.	Little and many granules.	Several, very large and irregular, and of a deep yellow colour.	Vegetable cells.	A few scales.	None.	None.	

P.S.—Since the above was placed in the printers' hands, I have been kindly furnished with the following letter from Mr. Quekett, for publication. The opinion of so high an authority will bear, I am sure, great weight.

Clifton, Sept. 21st, 1849.

Royal College of Surgeons,
Sept. 20th, 1849.

MY DEAR SIR,—I have carefully examined the specimens procured by you

from the air of cholera districts, choleraic vomit and evacuation, submitted for my opinion on Friday, September 14th; as also a specimen obtained from the atmosphere this day, and have no hesitation in stating that in my judgment they are successive stages of development of the same body, which I believe to be of a fungoid nature.

Yours very truly,

JOHN QUEKETT.

Dr. F. Brittan.

